REMARKS

35 U.S.C. § 103 Rejections

The Examiner has rejected claims 1-4, 6-14 and 16-17 under 35 U.S.C. § 103(a) as being unpatentable over Nguyen in view of Nelson.

Claim 1 has been amended to include a solder material interconnecting the non-fusible particles to form columnar structures within the phase change polymer. Specifically, claim 1 includes limitation "the solder material interconnecting the non-fusible particles to form a plurality of columnar structures within the phase change polymer."

Nguyen does not disclose a solder material interconnecting non-fusible particles to form columnar structures within a phase change polymer. Nguyen discloses an interface material composition which comprises a rubber, such as a hydrocarbon rubber, a phase change material, such as paraffin waxes or polymer waxes, and at least one thermally conductive filler (col. 2, lines 11-14). Thermal filler particles dispersed in the phase change mixture preferably have a high thermal conductivity (col. 4, lines 4-6). Suitable thermal materials include silver, aluminum, cooper and alloys thereof; boron nitride, aluminum nitride, silver-coated cooper, silver-coated aluminum, carbon fiber, metal-coated carbon fiber such as nickel-coated fiber, boron nitride, and aluminum (col. 4, lines 6-12). Dispersion of the filler particles can be facilitated by addition of functional organic-metallic coupling agents such as organosilane, organotitanate, or organozirconium (col. 4, lines 12-15). Nguyen thus discloses attempting to evenly disperse the filler particles throughout the phase change material. Therefore, Nguyen

specifically teaches a way from forming columnar structures within the phase change polymer using non-fusible particles. Specifically, Nguyen does not teach or suggest a solder material interconnecting non-fusible particles to form columnar structures within a phase change polymer.

Nelson does not teach or suggest a solder material interconnecting non-fusible particles to form columnar structures within a phase change polymer.

Nelson does not disclose a solder material and a plurality of thermally conductive particles. Nelson discloses a thermally and electrically conductive adhesive material comprising a hardened adhesive and a non-solidified filler containing a liquid metal dispersed in separate spaced regions of the adhesive (Abstract). As illustrated in Figure 2, a filler containing a liquid metal is provided, which is dispersed into an unhardened adhesive (col. 5, lines 41-43). Liquid metal is the key component of the adhesive material due to its excellent thermal and electrical conductivity as well as its liquidity (col. 5, lines 45-48). As used herein, the term "liquid metal" is defined as being gallium, mercury, or a compound containing gallium or mercury (col. 5, lines 48-50). That is, the "liquid metals" of the present invention are a class of materials which remain so named even if cooled and solidified (col. 5, lines 50-53). Such materials are not solders. Nelson makes no mention of a thermal interfaced material having a solder material and a plurality of thermally conductive particles. Thermally conductive adhesives with dispersed solids have been devised for heat sink attachments of electrical components and for attachment of integrated circuit chips to substrates and other packaging structures (col. 1, lines 47-51). For instance, silver filled epoxies for

electrical and thermal interface connections are well known. Although the basic theory of this method appears sound, in practice this method may have serious drawbacks (col. 1, lines 51-56). Since the thermal conductivity of such adhesives depends on the ability of the solids within the adhesives to contact each other and the surfaces to be joined, limited contact areas introduce constriction resistance and reduce the thermal conductance of the joint (col. 1, lines 52-61). Furthermore, there has been some recent activity directed towards overcoming this primary shortcoming with the use of low temperature solder fillers (col. 1, lines 64-67). Although rendering solder fillers molten provides better surface contact than, say, silver filled epoxies, significant drawbacks arise, particularly after resolidification (col. 2, lines 33-36). Solders appear to require heating well above their melting point to wet the surfaces being joined, require flux unless the surfaces are reduced immediately prior to bonding, lack physical compliance, are prone to deformation and fatigue, and are unable to wet most materials besides metals (col. 2, lines 36-41). Therefore, not only does Nelson fail to disclose the use of a solder material and a plurality of thermally conductive particles, but Nelson teaches a way from using either a solder material or a plurality of thermally conductive particles in a thermal interface material. Specifically, Nelson does not disclose and actually teaches away from a solder material and a plurality of thermally conductive particles.

Therefore, claim 1 is patentable over Nguyen in view of Nelson because claim 1 includes a limitation that is not taught or suggested by Nguyen or Nelson.

Claims 2-4, 6-14 and 16-17 are dependent on claim 1 and should be allowable for the same reasons as claim 1 stated above.

Applicant, accordingly, respectfully requests withdrawal of the rejections of claims 1-4, 6-14 and 16-17 under 35 U.S.C. § 103(a) as being unpatentable over Nguyen in view of Nelson.

The Examiner has rejected claims 1-4, 6-14 and 16-17 under 35 U.S.C. § 103(a) as being unpatentable over Salyer in view of Nguyen and Nelson.

Claim 1 has been amended to include a solder material interconnecting non-fusible particles to form columnar structures within a phase change polymer.

As previously discussed, Nguyen and Nelson do not teach or suggest a solder material interconnecting non-fusible particles to form columnar structures within a phase change polymer.

Salyer does not teach or suggest a solder material interconnecting non-fusible particles to form columnar structures within a phase change polymer. Salyer teaches a composite useful in a thermal energy storage formed from crosslinked polyethylene having a straight chain alkyl hydrocarbon incorporated therein as a phase change material (col. 2, lines 29-33). No mention is made of columnar structures within a phase change polymer. Specifically, Salyer does not teach or suggest a solder material interconnecting non-fusible particles to form columnar structures within a phase change polymer.

Therefore, claim 1 is patentable over Salyer, in view Nguyen and Nelson because claim 1 includes a limitation that is not taught or suggested in Salyer, Nguyen, and Nelson.

Claims 2-4, 6-14 and 16-17 are dependent on claim 1 and should be allowable for the same reasons as claim 1 stated above.

Applicant, accordingly, respectfully requests withdrawal of the rejections of claims 1-4, 6-14 and 16-17 under 35 U.S.C. § 103(a) as being unpatentable over Salyer in view of Nguyen and Nelson.

Applicant respectfully submits that the present application is in condition for allowance. If the Examiner believes a telephone conference would expedite or assist in the allowance of the present application, the Examiner is invited to call Mark A. Kupanoff at (408) 720-8300.

Pursuant to 37 C.F.R. 1.136(a)(3), applicant(s) hereby request and authorize the U.S. Patent and Trademark Office to (1) treat any concurrent or future reply that requires a petition for extension of time as incorporating a petition for extension of time for the appropriate length of time and (2) charge all required fees, including extension of time fees and fees under 37 C.F.R. 1.16 and 1.17, to Deposit Account No. 02-2666.

Respectfully submitted,

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